Marbled Murrelet At-Sea Meeting
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Meeting Overview
Our goal was to begin developing a sampling design for the Northwest Forest Plan monitoring program. To facilitate those discussions, each researcher brought in maps depicting their sampling areas, transect intensities, configurations, etc., from past years. Tim Max asked researchers to explain their previous sampling design in common statistical and sampling terms to help us all gain a common understanding of the terminology for each of these factors. We need to keep them in mind when we develop our monitoring program. Statisticians wanted previous sampling designs explained in the following terms:

Target population (in terms of spatial, temporal within year, temporal across years)
Sampling frame (sampled population)
Sampling units
Sample selection rules (inclusion probability)
Sample size (number of sampling units selected)
Sampling frequency
Timing of sampling

Each researcher explained their previous sampling design, then we began to define our target population spatially in terms of distance offshore. We tentatively described our target population offshore as that area immediately offshore from the breakers (~300 meters) offshore to 3 kilometers. We began to discuss spatially defining our target population in terms of the area along the coast. We will need to clearly articulate cost/benefits for program managers for different options. We also began to define our target population temporally. In life history time frames, we could define our target population in terms of pre-nesting season, nesting season, post-nesting season, or year-round.

Sampling Design Issues - Target Population
Our conceptual idea of a population for the purpose of sampling ultimately needs to get down to an area and time frames. For statistical purposes need way of making sure we can make inference to a larger population. Need to develop a statistically defensible monitoring system for population.

Offshore Distribution
The researchers have not been trying to monitor the entire population. Given that they know birds are closer to shore, they are monitoring an index of the population. They believe this subpopulation reflects larger population. Researchers think they have empirical data to justify

making inference about whole population, therefore, they don't need to sample all population (ie. 80% of population is near shore). What about when there's a shift offshore? We shouldn't ignore this. How much does this change day to day, how much does it affect our sampling? We know a huge variation can occur on day to day basis.

Regarding the offshore probability distribution curves. It is not enough to know the kind of function of the curve, need to know what density estimates are for a given area. Otherwise we can't sample this way and make inferences about the target population. If we want to make inferences about an entire population we want to make sure that our estimates are defensible. We'll need to defend it to reviewers. Precision is also an issue. It would be very expensive to define the offshore distribution curve every year. Could we revisit curve every couple of years? Some researchers think we do know enough to cut off the tail of the offshore distribution. (Not discussing sampling yet but note we can potentially use the information from curves to stratify sampling in near and offshore areas).

Model Based versus Design Based assessment of the distribution offshore defining the width of the reference population. This also would affect our stratification of the population and sampling within the strata.

> Model Based - Using existing data, we would determine a probable offshore distribution. This model is weaker statistically because its not enough to know the function of the curve (i.e., shape), need to know densities for a given area.

> Design Based - Every year assess the offshore distribution for a given area. Likely would be expensive to get representative samples for each area.

Note the topic of Model VS Design Based assessments needs MUCH further and more in-depth discussion in the future.

We tentatively set the width to be from the breakers (~300 meters) to 3 kilometers. Probably gets most of the birds. We will try to understand what portion of the biological population that represents, but can we say %? Can only speak to data we have, years we have, areas we've covered. Sherri said she'd go back to double check their data against this width. Chris says he'll go look at other offshore data also MacArthur. How far can you bring the line in and defend it that your getting the majority of the birds. Help make the argument linking distance we chose.

Along Shore Distribution
We began discussing where we should be defining our target population along shore. Although our group is responsible for monitoring the federal land base, the effectiveness monitoring plan recommends developing a sampling plan that could incorporate non-federal needs (and benefit from their financial contribution). The Recovery Plan divides the species' range into zones and recommends monitoring each zone in a coordinated manner. The Northwest Forest Plan monitoring process is probably the most logical way to coordinate and monitor recovery of the species. However, the sampling plan needs to be robust for the federal land base before trying to incorporate other areas. Want to provide a scientifically defensible sampling plan that interested

entities participate in by contributing their money or expertise.

Some discussion that managers need information about whether populations are doing better on federal versus non federal land or if they are doing the same despite very different land management practices. Some concerns were voiced as to whether we will be able to make inferences. The definition of the target population becomes critical and determines the validity of inferences later. We know we won't be able to tie particular birds to a particular piece of land, but hope we can identify trends over time and associated landscape condition. The habitat mapping effort will cover both federal and non federal land. Want to understand what factors at large scales that affect the population. One possibility is dividing each zone into smaller areas (sampling units) and get population trends for each sampling units.

Tim noted that defining the population is not a scientific issue, it's a management issue. Managers should be given several choices. Could set out options for the full area or federal only. Steve thinks it becomes scientific if we want a comparison between federal and non-federal land. There are certain research needs as well. We will take the managers several options with costs outlined for each. Need to articulate pros and cons for all options.

Options:
1. One inference, entire range - one population over range.
2. One inference, federal only - one population over range.
3. Different inferences by zone, entire range - subpopulations with independent inferences.
4. Different inferences by zone, federal only - subpopulations with independent inferences.
5. Different inferences by smaller units within zone over entire range.
6. Different inferences by smaller units within zone over federal only.

	Sampling Frame (Sampled Population)	Pros/Cons	Cost Estimates
One Trend	Whole Coast		
	Federal Coast		
One Trend Per Conservation Zone	Each Zone		
	Each Zone With Federal Lands		
One Trend Per Subsection of Conservation Zone	Each Subsection		
	Each Subsection With Federal lands		

Any subdivisions will have birds moving across boundaries. Its one of the errors that will be associated with any size division.

Funding

Concerns raised about agencies supporting monitoring intermittently such that data analysis is not consistent. Funding needs to be fundamentally stable. Would not want to have to reduce sample sizes or numbers of replicates, re-analyze data, etc. Currently, there is no pot of money for monitoring; each agency is giving money or people as they think their budgets allow. However, monitoring is considered part of the Northwest Forest plan.

Inland Distribution
Had a brief discussion about FEMAT zones 1 and 2, the lines that run parallel to shore. Distance inland differs from state to state; WA 55 miles, OR 50 miles, CA-narrows down further. Note there is debate over inland distances in Southwest Oregon and research in CA is finding birds absent from areas once presumed to be within the species' inland range.

Temporal Distribution
We need to provide a temporal description of the target population. We need to think about the calendar year, nesting season, and between years and seasons. Some temporal options are: pre breeding, during breeding, post breeding. (Marty gets drastic differences and considers each as a sub season).

During prebreeding there are presumably more stable numbers because a higher percent of the birds are on the water. But they aren't necessarily tied to land base. How could prebreeding be tied to a site? Some radio telemetry work but probably don't know.

During the breeding season, the advantage is the birds are tied more closely to their breeding sites. Cons are greater fluctuations because of birds incubating, feeding, fledging, leaving. Incubating birds are gone (always one of the adults on the nest), then start to see young on the water. And the portion of the population that is breeding may change given different foraging conditions. After incubation usually have 2 months. Sherri most comfortable with this part of season, but you have to get out on the water and have forest information to know when that is. You can't put a calendar month on it because it changes year to year. Bracketing is probably the best option, taking samples before, during and after. Steve suggests we begin to incorporate early season surveys for a couple of years until we can get better data to determine the best time of year to survey. Costs associated with this. What do you gain? Is there any research on this issue of variance around prebreeding vs breeding counts? Sherri has about 5 years of early start data she could look at.

Productivity? Need to discuss feasibility, necessity, logistics, information gained.

Spatial Simulation Model
Steve had more difficulty than anticipated "smoothing the curves" of the histograms. They had numbers at discrete distances, but not continual offshore sampling. It took a lot of mathematical work to fill in the numbers between the histogram columns. Now have the problem solved.

Steve asked the group about potential transect configuration for spatial simulation model. Needs to narrow some of the options. There will be some logistical constraints, some statistical constraints. Steve showed sawtooth, zigzag, parallel, square, perpendicular (or latitudinal lines).

Jim's suggests ignoring sawtooth and zigzag, couldn't do the model with them. Some discussion about transect lengths as it affects these decision. Tim wants to see perpendicular. Note the boat 'down' time at $100/hour boat rental is costly. Randomly placed or clumping systematic. Jim's suggestion is several parallel to shore (maybe 5) with less effort the greater distance offshore. Maybe standardize the lengths.

Next Meeting Date
March 11, 1999, at the Duncan Plaza Bldg in Portland. Times to be determined.